We Can Do Better: Going from Research to Impact in Engineering Education

Jeremi S. London, Ph.D.

EEC Grantees Conference – Keynote Address

October 31, 2017

If you could use an image to depict impact, what would it be? (Use dashes between multiple words.)

Respond at **PollEv.com/jeremilondon882**

Text **JEREMILONDON882** to **22333** once to join, then text your message

No responses received yet. They will appear here...

Total Results: 0

Poll Everywhere

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ASU – Tempe Campus

Arizona State University

ASU – Polytechnic Campus

impactfulresearch.com

RISE
Research Impact in STEM Education

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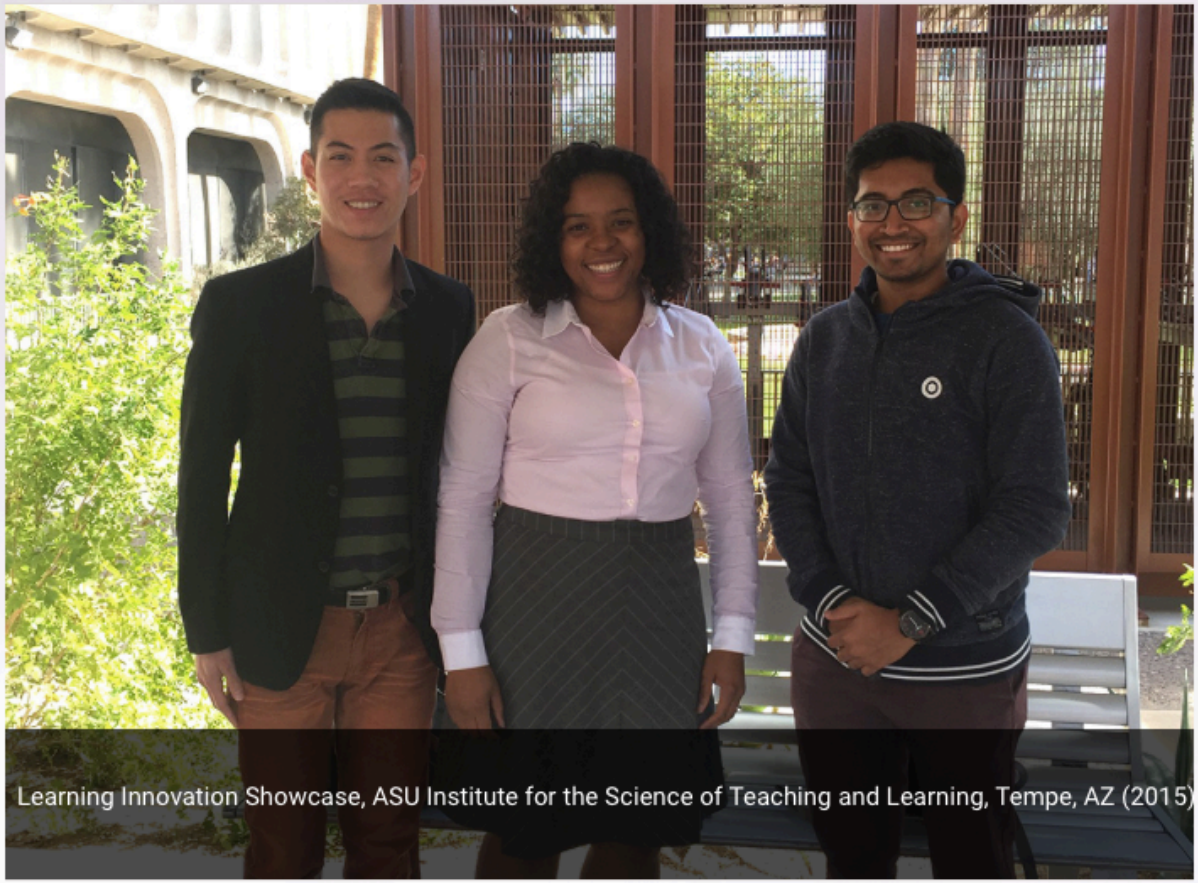


Learning Innovation Showcase, ASU Institute for the Science of Teaching and Learning, Tempe, AZ (2015)

Welcome to RISE

The Research & Impact in STEM Education (RISE) Research Group uses mixed methods research designs to investigate the impact of STEM education research, and strives to make an impact on STEM education through research.

LEARN MORE →

THE LATEST:

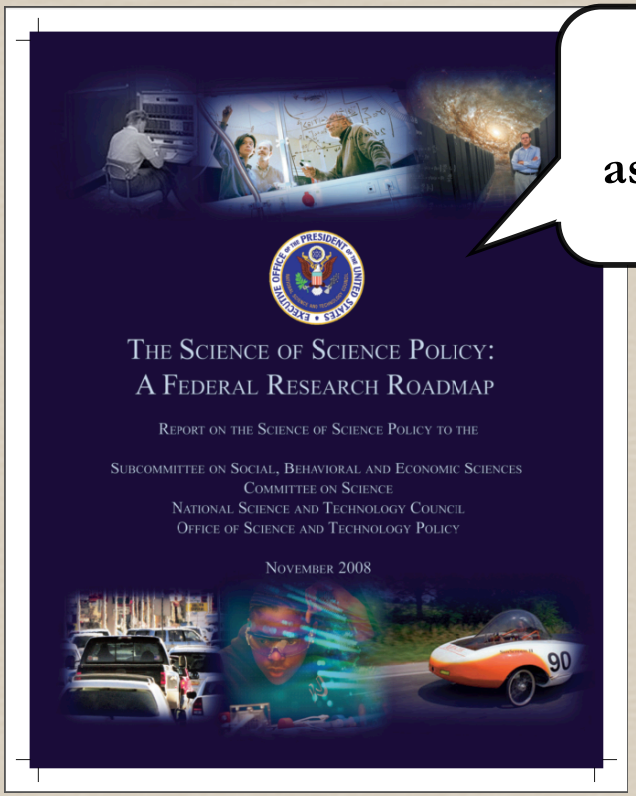
Dr. Jeremi London will be giving a keynote on October 31, 2017 at the 2017 NSF EEC Grantees Conference. More here.

Recent NSF award: See who it is!

NSF Summer Scholars (2011)

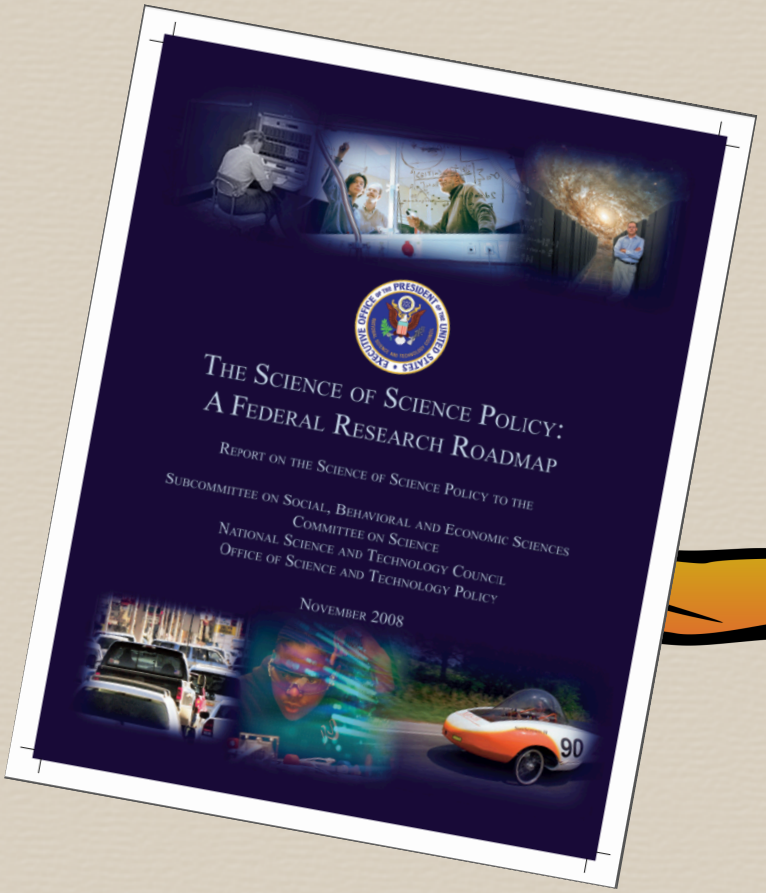
Q1: What does it mean for (my) research to have impact?

Shifts in Interest on Understanding Impact

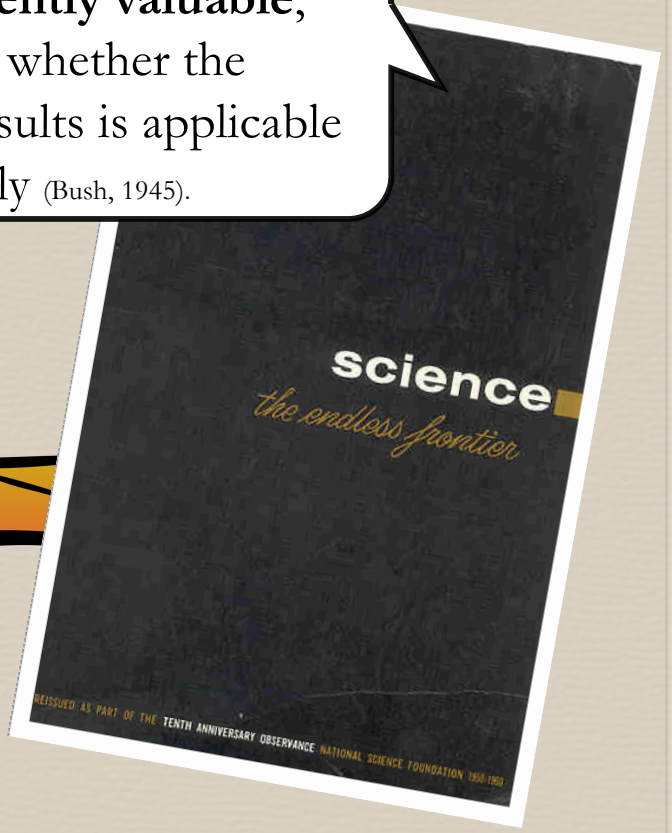


Goal: To provide a rigorous basis from which policy makers and researchers can **assess the impact** of the Nation's scientific and engineering enterprise (NSTC, 2008).

Shifts in Interest on Understanding Impact



Science is **inherently valuable**, regardless of whether the knowledge that results is applicable immediately (Bush, 1945).



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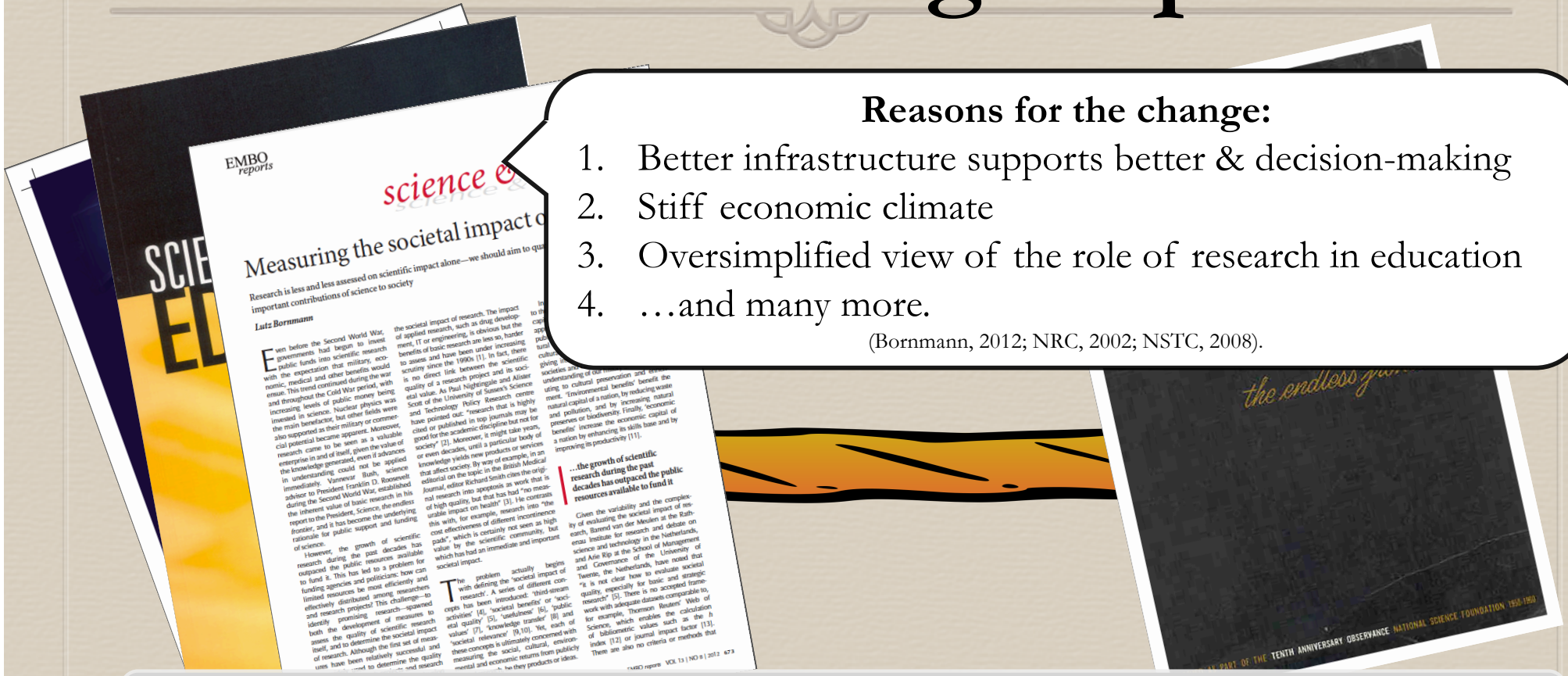

Reasons for the change:

1. Better infrastructure supports better & decision-making
2. Stiff economic climate
3. Oversimplified view of the role of research in education
4. …and many more.

(Bornmann, 2012; NRC, 2002; NSTC, 2008).

The research that will continue to be supported is research that demonstrates **IMPACT**.

Three Difficulties Associated with Studying Research Impact

London, J., Cox, M. (2015). The Beginning of a Scholarly Conversation on Impact in Engineering Education: A Synthesis of the Three Major Difficulties Associated with Studying Research Impact. *Proceedings of the Australasian Association for Engineering Education Annual Conference, Victoria, Australia.* [Best Overall Paper Award]

Defining Research Impact

Impact is a **time-sensitive** interpretation of the **extent to which change** has happened **in and beyond** the context in which the change originated.

Scientific Impact: Advances in reliable knowledge (theories, methods, facts, models) that primarily influence academic communities

(Bornmann & Marx, 2014; Donovan, 2011; Godin & Doré, 2005)

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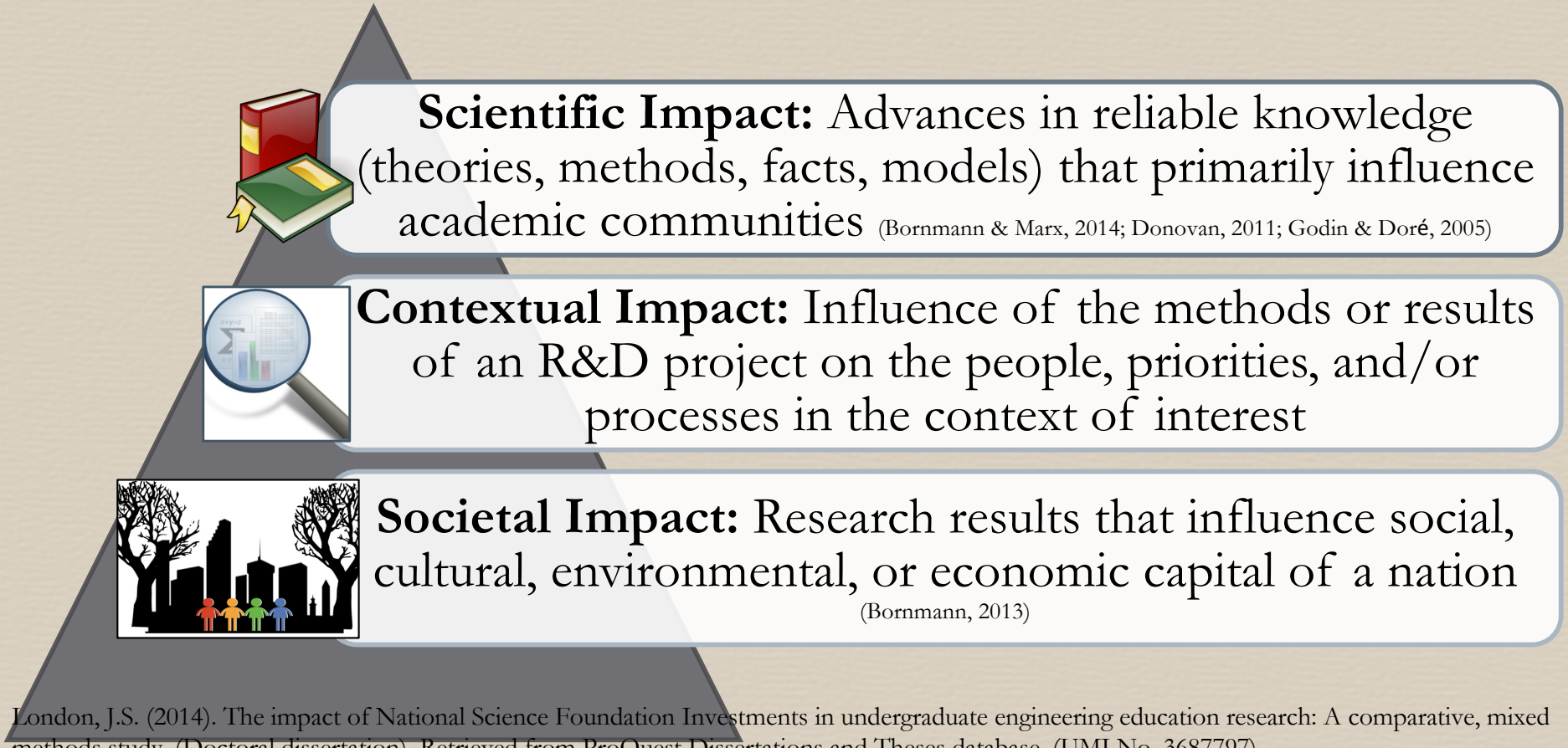

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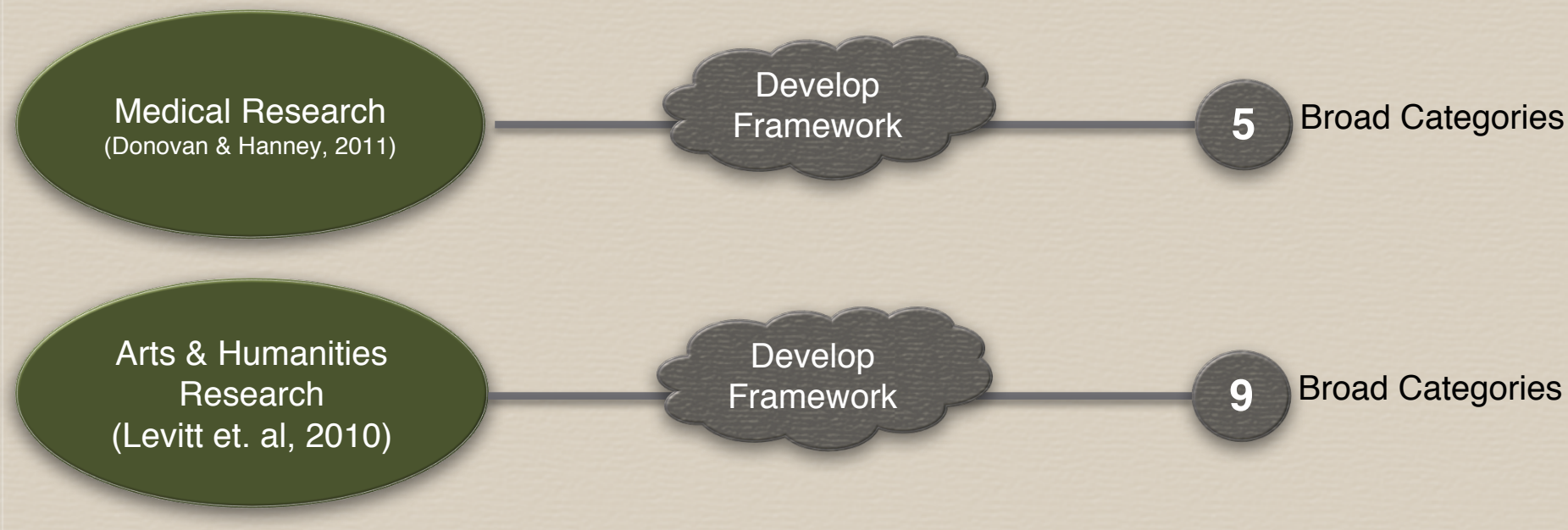
Disciplinary Perspectives on Impact

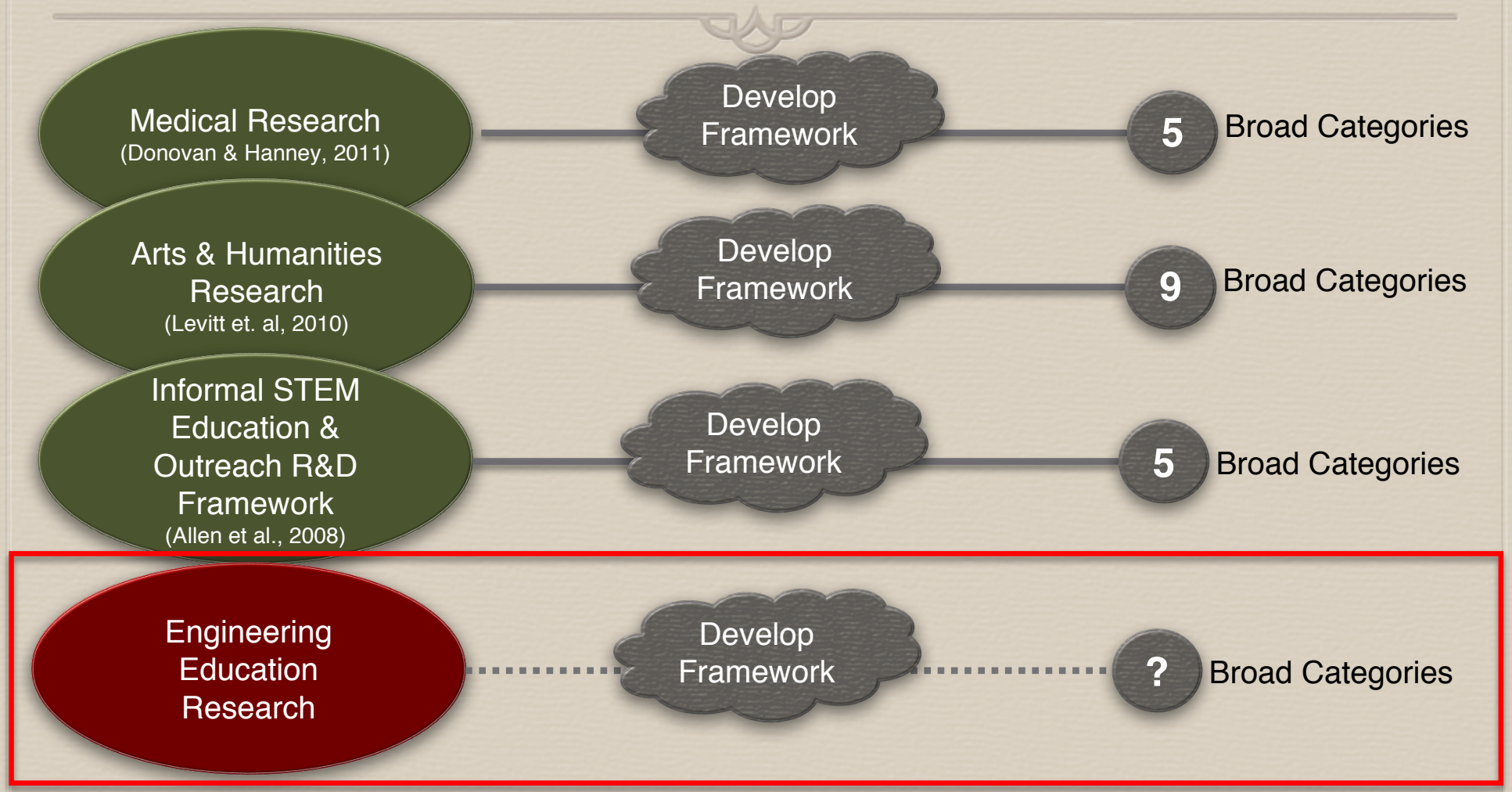
Framework: "exposition of a set of assumptions, concepts, values, and practices that constitutes a way of understanding the research within a body of knowledge"



Disciplinary Perspectives on Impact

1) Awareness, knowledge, or understanding of STEM concepts, processes, or careers
2) Engagement or interest in STEM concepts, processes, or careers
3) Attitudes towards STEM-related topics or capabilities
4) Behaviors related to STEM concepts, processes, or careers
5) Skills based on STEM concepts, processes or careers

Disciplinary Perspectives on Impact



Q2: How can we collectively characterize the impact of engineering education research?

Acknowledgements

- NSF Awards: EEC-1564629, EEC-1564509

Any opinions, findings, conclusions, recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

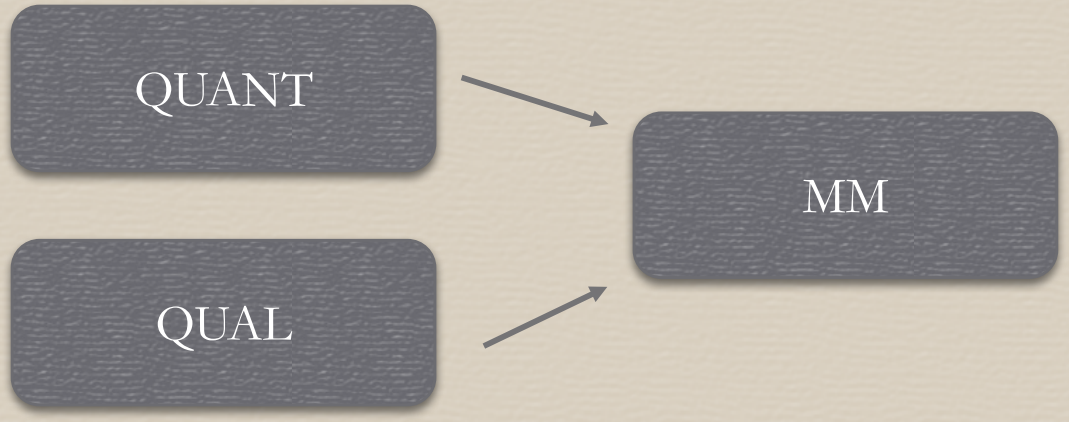
- Collaborator: Dr. Maura Borrego (UT-Austin)

Project Overview

- Develop an engineering education research impact framework that is informed by the community and internationally inclusive
- Describe researchers', administrators, and practitioners' insights on the role of research in engineering education practice

Research Design & Questions

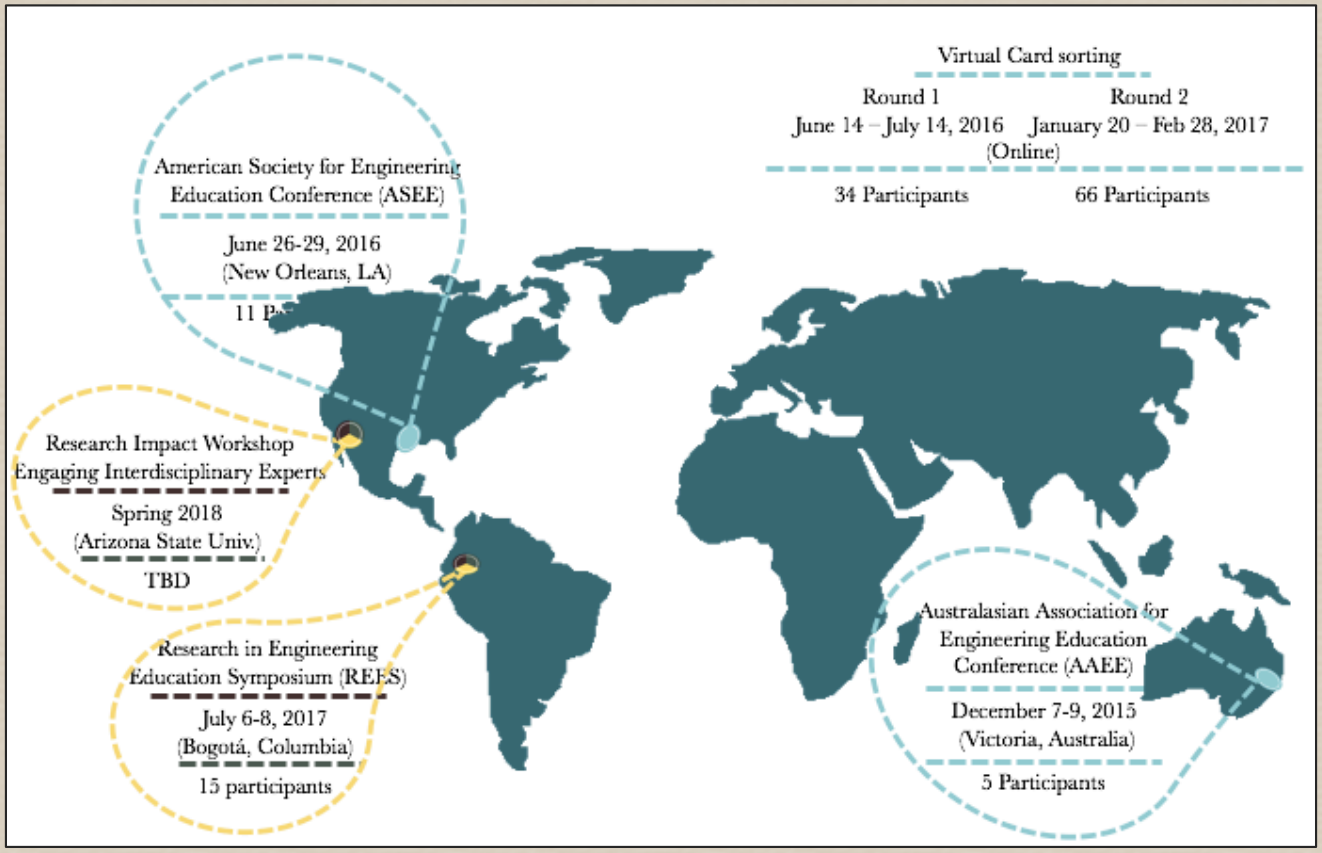
Convergent Parallel Mixed Methods Design
(Creswell, Plano-Clark, 2011)



RQs:

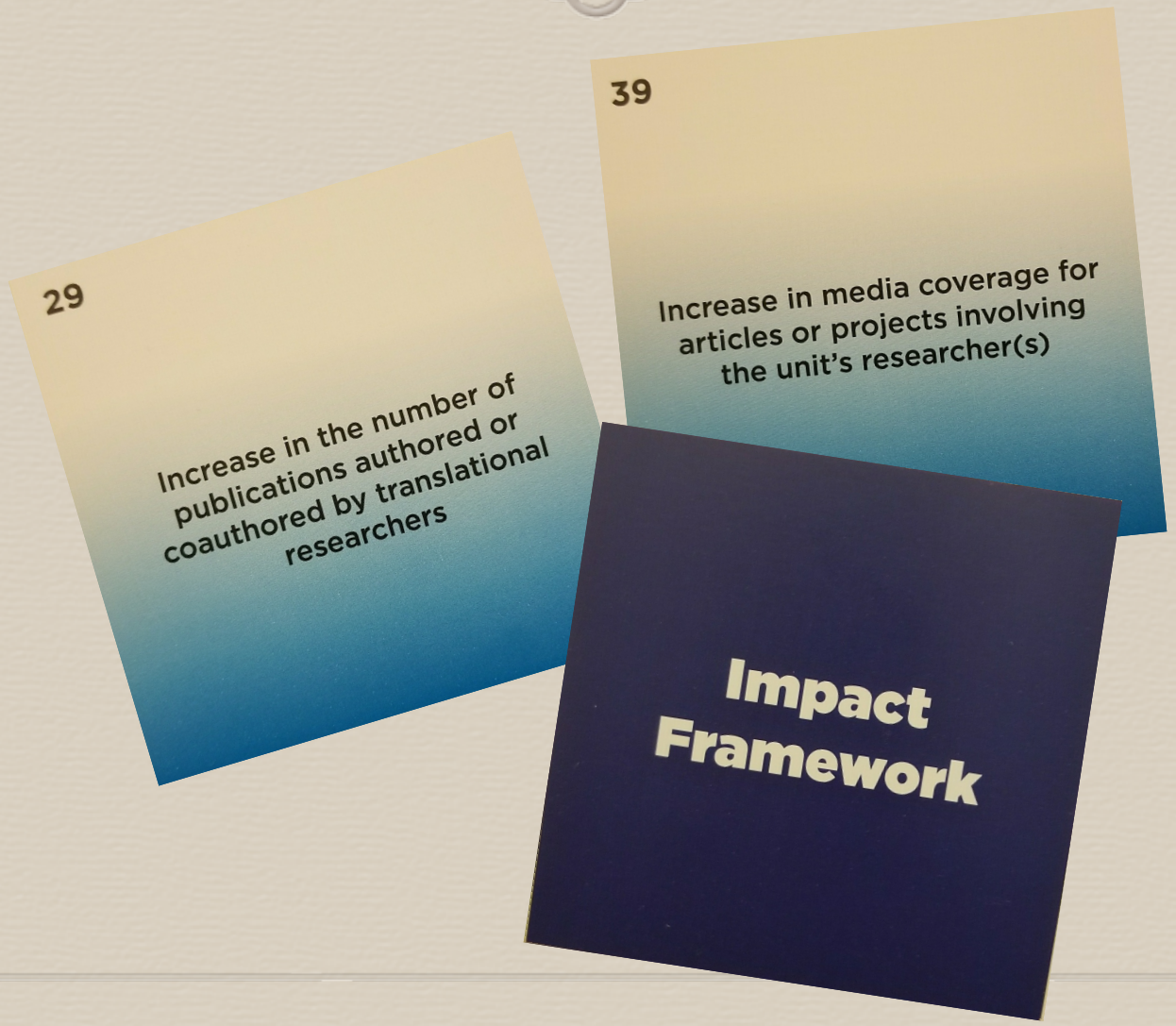
- **What is a meaningful and shared description of the impact of engineering education research, according to engineering education researchers? (QUANT)**
- How do different engineering education practitioners –including non/tenure-track faculty, department chairs, co-curricular support personnel, engineering deans and engineering staff advisors— perceive the impact of engineering education research? (QUAL)
- To what extent does the interview findings with practitioners agree with and expand the data used to develop a framework characterizing the impact of engineering education research? (MM)

EER Impact Community-Informed Framework



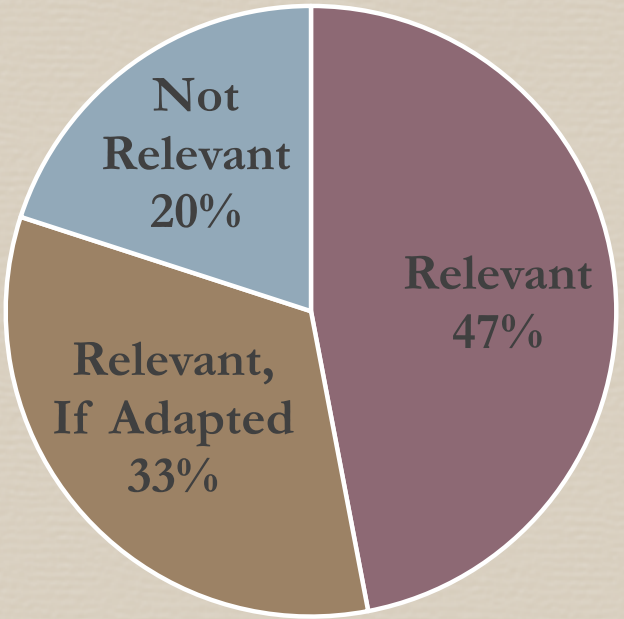
Messick's Theory of Instrument Development (Messick, 1995, 1996; Purzer, Cardella, n.d.)

Card Sorting Activity



Preliminary Results

Overall Categorical Distribution (n = 125 cards)



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Preliminary Results

Relevant to Engineering Education

Increase in the stock of scholarly resources that advance knowledge and understanding

Development of educational resources (e.g., curricula, pedagogical tools, training materials, teaching instruments)

Creation of an intellectual climate that influences decision making, policy development, and programs around a variety of issues that affect citizens (e.g., education, national security).

Barriers to efficiencies in the research process are identified and strategies for overcoming those barriers are developed (e.g., shortening the time to IRB approval, ease of completion of required documents)

Not Relevant to Engineering Education

Findings and discoveries from bench science are incorporated into studies involving animals or humans

Relevant, if Adapted

Medical practice becomes more evidence based

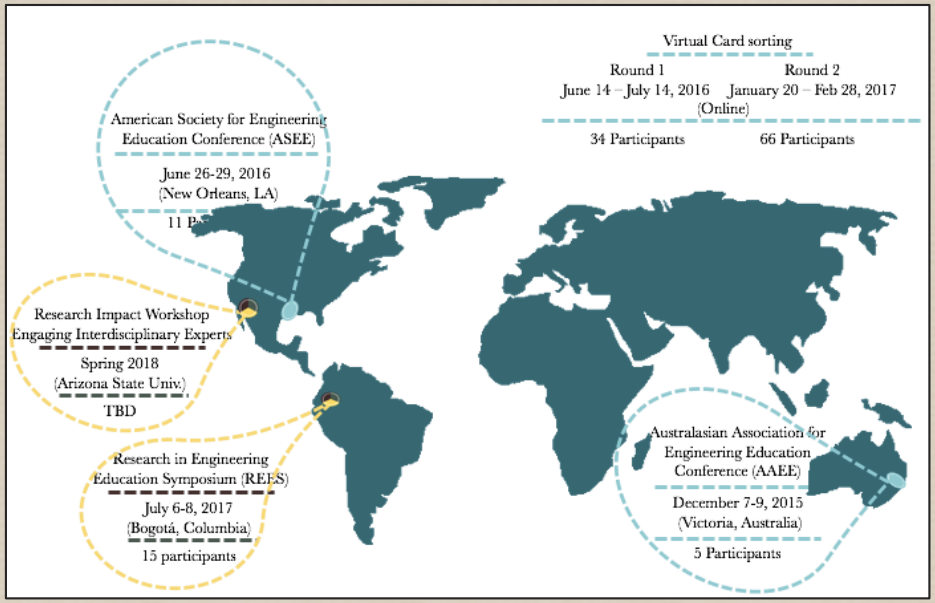
Self-efficacy and empowerment among health care consumers increases

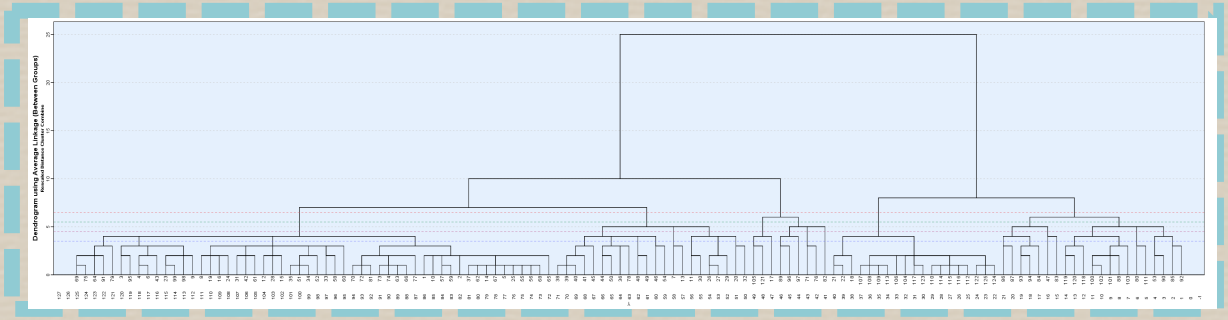
Improvements in the delivery of effective and efficient health care services are made

EER Impact Community-Informed Framework

To Recommend Workshop Participants:
http://tinyurl.com/yc6pgmcz

To Stay Informed about Findings:
www.Impactfulresearch.com





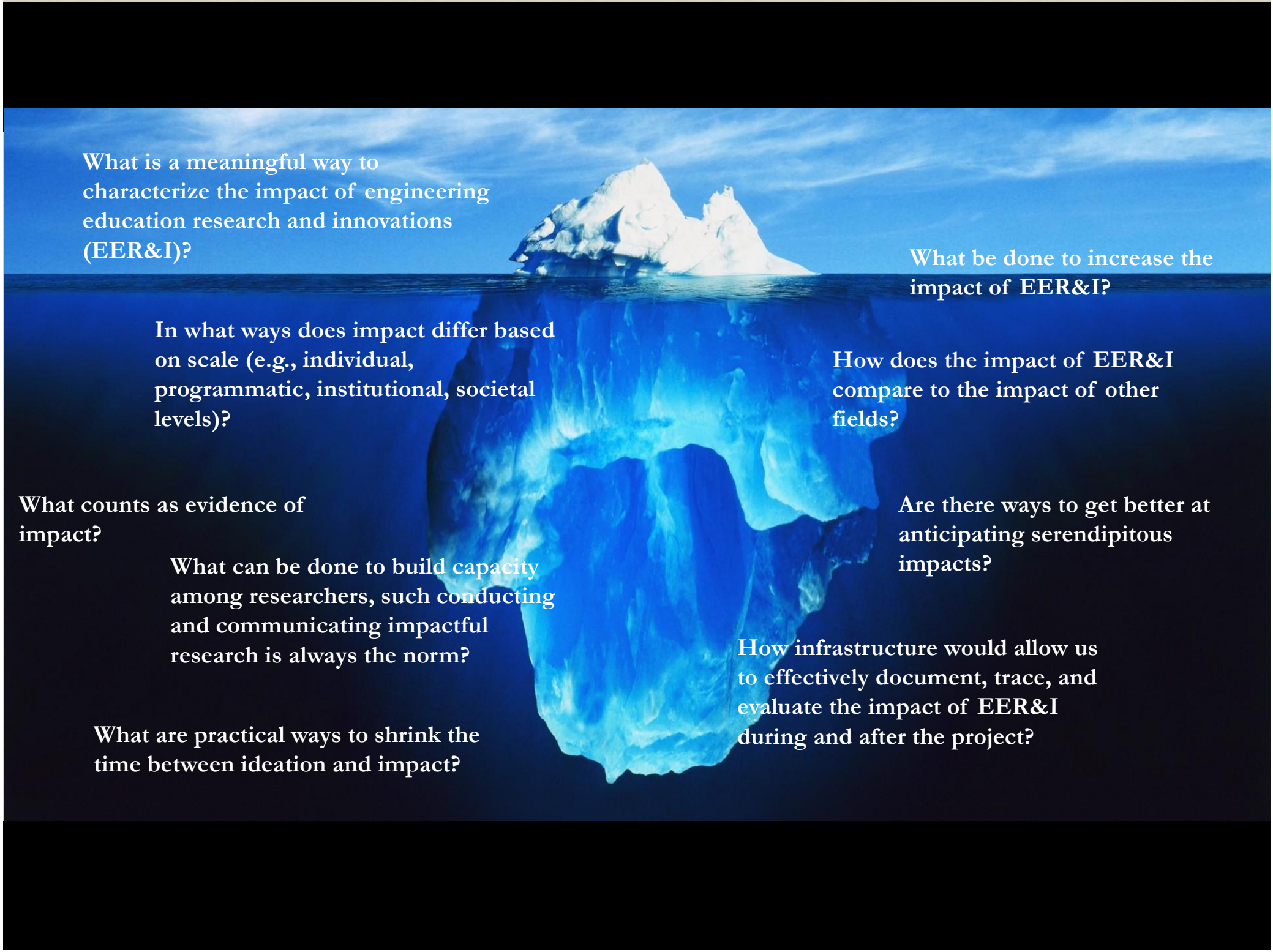
Preliminary Hierarchical Cluster Analysis Results

Anticipated Impact

Scientific Impact: Advance the scholarship of impact by developing a framework that is robustly relevant to a wide range of engineering education research and innovations (EER&I).

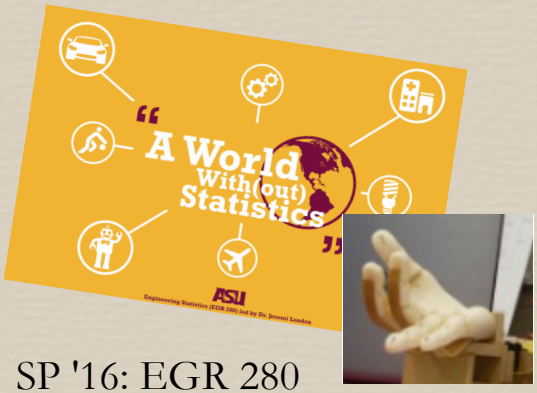
Contextual Impact: Facilitate the use of shared language among engineering education stakeholders around the world, and clarity about what the impact of EER&I looks like. Provide a strong basis for discussions on how research *should* influence practice.

Societal Impact: Engaging the global engineering education research community in the framework development positively impacts awareness, quality, robustness of usability/applicability, dissemination and buy in. This should lead to more realized impacts of EER&I.


What is a meaningful way to characterize the impact of engineering education research and innovations (EER&I)?
What be done to increase the impact of EER&I?
In what ways does impact differ based on scale (e.g., individual, programmatic, institutional, societal levels)?
How does the impact of EER&I compare to the impact of other fields?
What counts as evidence of impact?
Are there ways to get better at anticipating serendipitous impacts?
What can be done to build capacity among researchers, such conducting and communicating impactful research is always the norm?
How infrastructure would allow us to effectively document, trace, and evaluate the impact of EER&I during and after the project?
What are practical ways to shrink the time between ideation and impact?

Q3: How can I use this awareness to engage in activities that lead to greater impact?

From Research to Impact…



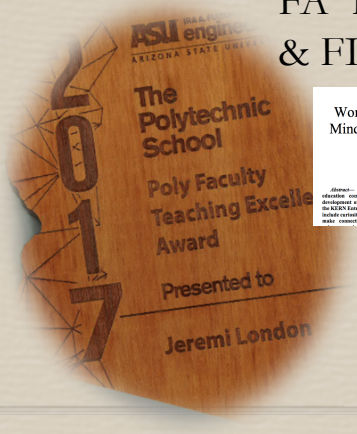
SP '16: EGR 280

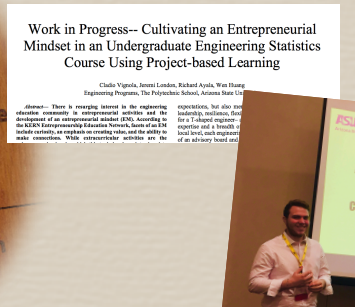
SP '17: EGR 280

FA '16: KEEN
Professorship Mini-grant

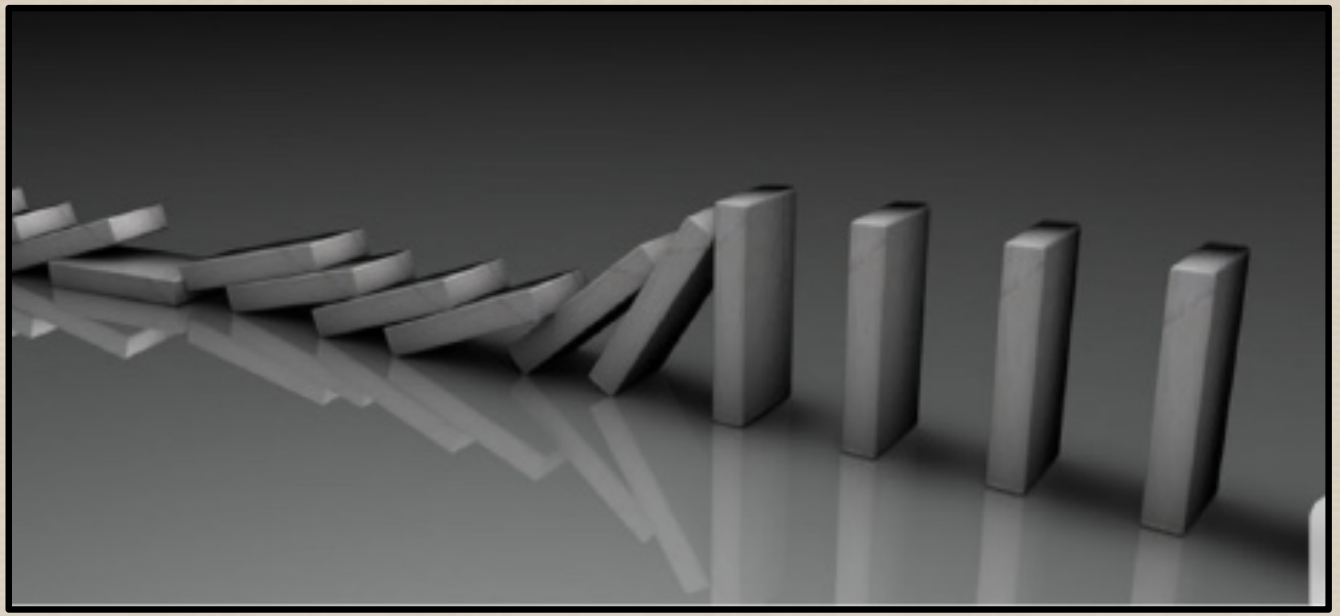
THE KERN FAMILY FOUNDATION

FA '17: Teaching Award
& FIE Proceeding




Work in Progress-- Cultivating an Entrepreneurial Mindset in an Undergraduate Engineering Statistics Course Using Project-based Learning

How will you make an impact?



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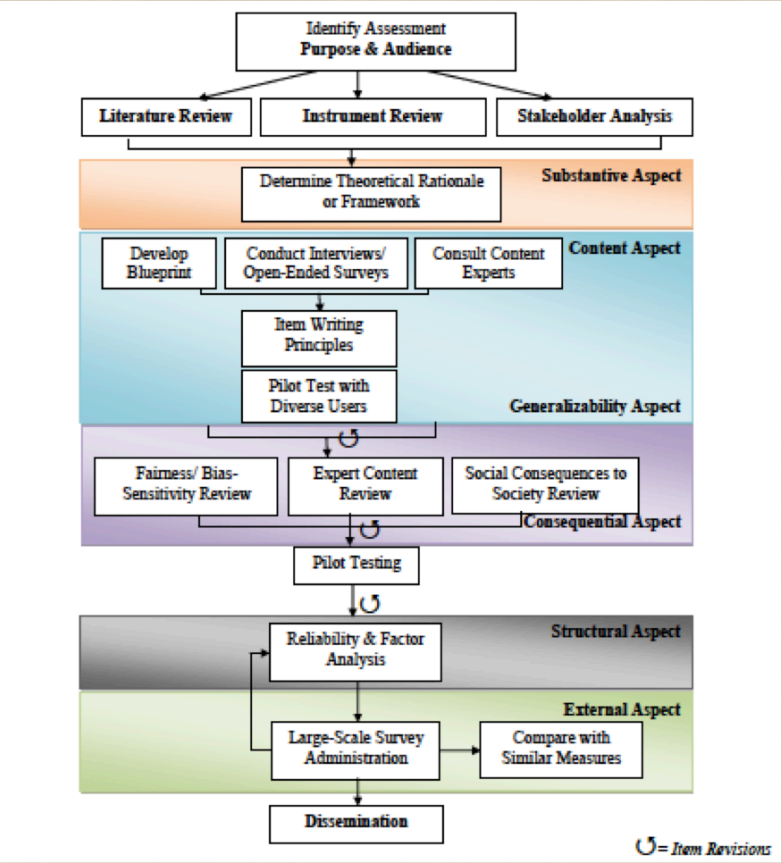
FYI - Theoretical Lens

Messick's Unified Theory of Instrument Development



(Purzer, Cardella, n.d.)